

Connector Coupling/Decoupling Tool

Field of the Invention

[0001] The present invention provides a tool for coupling or decoupling a connector from a connection port.

Background

[0002] Currently, a large number of electronic equipment are connected to electrical, optical or other forms of signal transmission cables by quick-connect/disconnect connectors of the plug and receptacle type. However, as electronic equipment becomes smaller, more components are being squeezed into tighter spaces. Accordingly, cables that service the components are also becoming densely packed. As more cables are attached to a piece of equipment, individual cable connectors have become more difficult to insert or extract from the equipment due to the corresponding increase in the density of cable connectors. The tight space between cable connectors prevent fingers from adequately reaching a particular connector without disturbing, and possibly damaging, adjacent connectors.

[0003] Tugging at the cables is an unsatisfactory alternative to plugging or unplugging the cables by the connectors because the components within the cables can be damaged by rough handling. In addition, most modern connectors have a locking feature to prevent inadvertent decoupling. Such a mechanism is a feature of most fiber optic connectors. Examples of such connectors include screw-in, snap-in and quarter-turn type locks. Conversely, the cables are generally too flexible to serve as a adequate handle for inserting the cable connectors into the equipment. Moreover, even if the cables are stiff enough to support the connector to insert the connector into its port, such an effort may also induce stress at the junction between the cable and the connector, once again damaging the components within the cable. It would be desirable

to have a hand tool that is capable of inserting and extracting cable connectors within an area having a high density of cable connectors without having to disturb the adjacent connectors.

Summary of the Invention

[0004] The present invention provides a connector tool capable of holding a cable connector, for coupling and/or decoupling the connector into or from a connector port in an area having a high density of connector ports. The connector tool comprises a sleeve and a gripper, wherein the gripper has at least two fingers that form a slot for engaging the connector. The fingers are capable of being drawn into the sleeve to form a compartment in interlocking engagement with the connector. In an embodiment, the connector tool is capable of handling a SC fiber optic cable connector. In another embodiment, the connector tool is capable of handling an electrical cable connector.

Brief Description of the Figures

[0005] **Figure 1** is a perspective view of an embodiment of the connector tool according to the invention, with a connector in the connector slot.

[0006] **Figure 2** is a perspective view of an embodiment of a gripper of the connector tool according to the invention.

[0007] **Figure 3** is another perspective view of an embodiment of a gripper of the connector tool according to the invention.

[0008] **Figure 4** is a perspective view of an embodiment of a sleeve of the connector tool according to the invention.

[0009] **Figure 5** is a perspective view of an embodiment of the connector tool according to the invention with the gripper fingers retracted within the sleeve.

[0010] **Figure 6** is a perspective view of an embodiment of the connector tool according to the invention prior to engaging a connector into the connector slot.

[0011] **Figure 7** is a perspective view of an embodiment of the connector tool according to the invention wherein a part of the connector is locked within the sleeve.

[0012] **Figure 8** is a perspective view of an embodiment of the connector tool according to the invention.

[0013] **Figure 9** is a perspective view of a transparent embodiment of an alternative gripper for use with the sleeve of the connector tool in **Fig. 8**.

Detailed Description

[0014] The invention is described by the following examples. It should be recognized that variations based on the inventive features disclosed herein are within the skill of the ordinary artisan, and that the scope of the invention should not be limited by the examples. To properly determine the scope of the invention, an interested party should consider the claims herein, and any equivalent thereof. In addition, all citations herein are incorporated by reference. In the context of this invention, substantially similar components are referenced by the same number in the different figures.

[0015] A connector coupling/decoupling tool **10** (hereinafter “connector tool”) according to the present invention comprises a sleeve **12** that is capable of sliding along an elongated gripper **14**. Gripper **14** has a handle **16** at one end and fingers **18** at a distal end from handle **16**. As shown in **Fig. 1**, fingers **18** form connector slot **20** spaced to engage connector **22**. An embodiment of gripper **14** is shown greater detail in **Fig. 2**. In this embodiment, slot **20** of gripper **14** is adapted to a substantially rectangular-shaped connector **22** as shown in **Fig. 1**. However, numerous cavity shapes are contemplated within the scope of the invention. Moreover, it is possible to use one cavity shape to handle a connector having a different shape, provided that fingers **18** can adequately engage the connector. In the present embodiment,

gripper 14 further comprises optional engagement lugs 24 on fingers 18 within slot 20 that is capable of engaging indents in the connector, or corners of the connector. Fingers 18 also comprise optional external stops 26 to engage an end of sleeve 12.

[0016] As shown in Fig. 3, the gripper body 28 of gripper 14 comprises a top wall 30 and two side walls 32 and 34 that form a cable slot 36. Cable slot 36 accommodates the cable as the cable connector is handled by the connector tool. As shown, walls 30, 32 and 34 terminate at one end as handle 16, while side walls 32 and 34 extend beyond top wall 30 to form fingers 18. While shown as a top wall attached to two parallel side walls that are attached perpendicularly to the top wall, the invention contemplates many different embodiments to form cable slot 36. Further, cable slot 36 need not extend to handle 16. It merely needs to provide sufficient space for accommodating the cable. Examples include: a single semi-circular wall; a single sidewall perpendicularly attached to parallel top and bottom walls; a bottom wall attached to sidewalls; or a wall attached at an angle to two other walls to form various trapezoidal shapes (e.g. wide bottom or wide top).

[0017] An embodiment of sleeve 12 is shown in greater detail in Fig. 4. Sleeve 12 comprises a first end 38 and a second end 40. As shown, sleeve 12 further comprises a top wall 42, two side walls 44 and 46 that forms a gripper channel 48 that extends through first end 38 and second end 40. At an end distal from top wall 42, juts 52 and 54 side protrude from the interior of walls 44 and 46, respectively, to form cable channel 50. Top wall 42 can comprise an optional finger rest 56 for use in conjunction with gripper 14. As indicated for the gripper, variations on the sleeve walls are within the scope of the invention, so long as the gripper fits within the gripper channel with sufficient tolerance that the gripper does not readily slide out of the sleeve, and the gripper fingers can cooperate with the sleeve to form a compartment that is capable of an interlocking engagement with the connector. See Fig. 8 for an embodiment having a rounded cross section. In a preferred embodiment, the cable slot of the gripper sufficiently overlaps the cable channel of the sleeve to provide sufficient space for the cable to move freely as the sleeve slides back and forth along the gripper. In another embodiment, the cable slot of the

gripper overlaps the cable channel of the sleeve only to the extent necessary for the fingers to be drawn into the sleeve.

[0018] An alternative embodiment having an alternative gripper handle 16 is shown in **Figs. 5 and 6**. It should be apparent that the shape of the handle can vary. It is preferred that the handle form a backstop to prevent gripper 14 from sliding all the way through sleeve 12. A typical SC fiber optic connector housing is shown in **Fig. 6**. In the embodiment shown, the connector comprises indents 58 and 60 that are capable of engaging lugs 24. In the absence of such indents, engaging lugs 24 can be positioned at the tip of the fingers to engage connector 22 at corners 62 (see **Fig. 8**). In the absence of engaging lugs 24, fingers 18 can comprise a plurality of gripping ridges or other forms of non-slip grip in slot 20 to for frictional mating with the connector. As shown in **Fig. 9**, an alternative gripper for use with the sleeve shown in **Fig. 8**, may include gripping ridges. In this embodiment, the gripper of **Fig. 9** has 3 fingers instead of 2. As shown, this embodiment is made from transparent plastic for better visualization of the connectors. An alternative embodiment of the connector tool is found in **Fig. 7**, having two finger rests on the side walls instead of one finger rest on the top wall.

[0019] In operation, the gripper is slidably mounted in the sleeve. See **Figs. 1 and 5-7**. In a first embodiment, the handle prevents the gripper from sliding through the sleeve from a first end. In another embodiment, external stops 26 prevents the gripper from sliding through the sleeve from a second end (**Fig. 7**). In another embodiment, gripper fingers flex outward so that when they are drawn into the sleeve, they apply pressure to keep the fingers compressed against the connector. In a further embodiment, gripper fingers do not flex outward, and the interlocking engagement is a consequence of the fingers and the sleeve cooperating to form a compartment sufficient to lock at least a portion of the connector within a compartment. In a further embodiment, the gripper channel tapers from a wider end at the gripper finger end to a narrower end at the gripper handle end. As the fingers are pulled into sleeve, the tapered channel gradually pinches the fingers together to further secure the connector within the slot.

[0020] Although the connector tool is made to engage connectors, the connector itself does not comprise part of the invention. Of course, an ordinary artisan would understand that the invention is not limited to use with any specific type of cable or cable connector, and can have a variety of configurations for general use with many different connectors and a variety of configurations for specific use with particular connectors. Examples of other types of cable connectors can include electrical cables connectors having substantially round cross-sections.

[0021] An example of the operation of the connector tool will begin with a cable connected to a component, wherein the cable connector of the cable is attached to a corresponding port in the component. With the gripper in the sleeve such that a handle end projects from a first end of the sleeve, and a set of gripper fingers is capable of projecting from a second end of the sleeve (**Fig. 6**), the assembly is manipulated so that the fingers project from the sleeve to fit the connector within the connector slot (**Fig. 1**). Once the connector is engaged in the slot, the gripper handle is pulled away from the sleeve, so that the gripper fingers are drawn into the sleeve on the other end (**Fig. 7**). In this manner, the connector is at least partially locked inside the assembly, and can be decoupled from its port by the assembly. Conversely, once a connector is locked in the assembly, the entire assembly can be moved forward to couple the connector into its port. To disengage the connector from the connector tool, the handle is pushed towards the sleeve, thereby projecting the gripper fingers beyond the end of the sleeve. Because the connector and the gripper fingers are no longer locked by the sleeve, the connector is capable of being disengaged from the gripper fingers.

[0022] When used with two hands, one hand secures the sleeve, while the other hand secures the gripper. The connector tool is also adapted for one-handed operation, in a manner similar to that of a syringe (see **Fig. 7** as an example). In either case, the connector tool operates by engaging a connector in its slot, then sliding the slot into the sleeve to form an interlocking engagement between the fingers, the sleeve and the connector. Once the connector is coupled or decoupled to a connector port, the connector is disengaged from the connector tool by extending the fingers of the gripper beyond the sleeve and sliding the connector out of the slot.

[0023] The connector tool in accordance to the invention can be made from materials selected from the group consisting of plastic, metal, wood, ceramics, composites, paper board and combinations thereof. Some embodiments of the connector tool have been made from plastics. Some embodiments are made from polycarbonate. An example of a polycarbonate is LEXAN WR2210 made by General Electric.